

DEPARTMENT OF THE ARMY
Omaha District, Corps of Engineers
106 South 15th Street
Omaha, Nebraska 68102-1618

:NOTICE: Failure to acknowledge : Solicitation No. DACW45 02 T 0043
:all amendments may cause rejec- :
:tion of the quote. See FAR : Date of Issue: 24 June 2002
:52.214-3 of Section 00100 : New Date for Receiving Quotes:
10 January 2003

Amendment No. 0004
02 December 2002

SUBJECT: Amendment No. 0004 to Specifications/Documents for Construction of
High Voltage Air Switch Replacement, Big Bend Dam, SD
Solicitation No. DACW45 02 Q 0005.

TO: Prospective Quoters and Others Concerned

1. The specifications/documents for subject project are hereby modified as follows.

a. Specifications. (Descriptive Changes.)

(1) Page 1 (Cover Page/Standard Form 1449), delete date and time of receiving quotes shown and substitute "10 January 2003" by "5:00".

(2) Page 2 (Section SF 1449 CONTINUATION SHEET (Page B-1)), Delete page and substitute with attached.

(3) Solicitation page 5, para. 1.2.2.1 TIME OF DELIVERY, delete "All work under this contract shall be complete within 450 days after date of receipt of signed contract." and substitute "Delivery of equipment required under this contract shall be made not later than 26 September 2003. All work under this contract shall be complete within 360 days after date of receipt of signed contract."

(4) Solicitation page 6, para. 1.2.2.4 INSTALLATION SCHEDULE, delete "Outage proposals will be considered for dates during the following two periods; the first from late August through early November 2002 and the second from late February through May 2003." and substitute " Outage proposals will be considered for dates during the following two periods; the first from late February through May 2003 and the second from late August through early November 2003."

(5) Solicitation page 12, After title: SPECIAL CONTRACT REQUIREMENTS, insert " - SECTION H".

(6) Solicitation page 54, EFAR 52.232-5001 CONTINUING CONTRACTS (MAR1995), para. (b) delete "The sum of \$250,000 has been reserved for this contact..." and substitute "The sum of \$460,000 has been reserved for this contact..."

(7) Solicitation page 56, delete "Furnish and Install new high voltage air switch replacement, including all line connections additional auxiliary switches, modifications, adjusting, electrical tests and functional tests." and substitute "Furnish and Install new high voltage line switch and circuit switcher replacements, including all line connections additional auxiliary switches, modifications, adjusting, electrical tests and functional tests."

(8) Solicitation delete pages 70 & 71 and substitute new pages 70 & 71 Measurement and Payment.

(9) Solicitation delete pages 93-112, DELETE section: High Voltage Air Switch Replacement; pages 93-112 and substitute new section; pages 93 - 113.

(10) Solicitation page 2, SERVICES AND SUPPLIES, Item 0009, under "Quantity and Units", delete "150 EST Lbs" and replace with "1 Job".

2. This amendment is a part of the quote documents and shall be included in the package or acknowledged by e-mail (Aleasha.D.Cotton@usace.army.mil). All other conditions and requirements of the specifications/documents remain unchanged. If the quotes have been mailed prior to receiving this amendment, you will notify the office where quotes are received, in the specified manner, immediately of its receipt and of any changes in your quote occasioned thereby.

a. Hand-Carried Quotes shall be delivered to the U.S. Army Corps of Engineers, Omaha District, Contracting Division (Room 301), 106 South 15th Street, Omaha, Nebraska 68102-1618.

b. Mailed Quotes shall be addressed as noted in Item 9 on page 1 (Cover page/Standard Form 1449).

3. Quotes will be received until 5:00 p.m., local time at place of receiving quotes, 10 January 2003.

U.S. Army Engineer District, Omaha
Corps of Engineers
106 South 15th Street
Omaha, Nebraska 68102-1618

02 Dec 2002
MFS/4411

DACW45-02-T-0043

SECTION SF 1449 CONTINUATION SHEET

SERVICES AND SUPPLIES

BIG BEND HIGH VOLTAGE AIR SWITCH REPLACEMENT

ITEM No.	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0001	Removal and Disposal of the Existing Air Switches	1	Job	XXXXXX	\$_____
0002	Furnish and Install New Transformer Grounding Switches, 1200 Amp Type HSG	4	Ea	\$_____	\$_____
0003	Furnish and Install New Transformer Disconnect Switches, 1200 Amp Type MOD	4	Ea	\$_____	\$_____
0004	Furnish and Install New Line Grounding Switches, 1600 Amp Type G	2	Ea	\$_____	\$_____
0005	Furnish and Install New Line Disconnect Switches, 1600 Amp Type MOD-1	2	Ea	\$_____	\$_____
0006	Furnish and Install New Paralleling Bus Sectionalizer Switch, 1200 Amp Type MOD	1	Ea	\$_____	\$_____
0007	Furnish and Install New Bus Support Insulator Stacks	24	Ea.	\$_____	\$_____
0008	Furnish Spare Parts	1	Lot	XXXXXX	\$_____
0009	Dispose of Asbestos Containing Material	1	Job	\$_____	\$_____
0010	Furnish and Install New Coupling Capacitor Voltage Transformers	6	Ea.	\$_____	\$_____
XXXX	Contract Data (See DD Form 1423 Exhibit B)		XXX	XXXXXX	NSP
				TOTAL	\$_____

NSP= Not Separately Priced

ESTIMATED BID ITEM The quantity for bit items marked EST is estimated and may be increased or decreased at the discretion of the Government.

MEASUREMENT AND PAYMENT

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- C. PAYMENT

MEASUREMENT AND PAYMENT

A. GENERAL INFORMATION

In each instance the contract price shall for an item constitute full compensation as here in specified, as shown, or as otherwise approved. The contract price and payment will also constitute full compensation for all work incidental to completion of the item, unless such work is otherwise specifically mentioned for separate payment under another bid item or as stated in the description of the payment. In the event any work is required by specification sections or by the drawings and not specifically mentioned in the measurement and payment paragraphs, separate or direct payment will not be made and all costs thereof are incidental to and included in the contract price and payments for all items listed in the bid schedule.

B. MEASUREMENT

Items measured as a job will be measured for payment as a complete job in the locations indicated or specified. This measurement includes all incidental work and materials such as fittings, fasteners, electrical materials, and O & M manuals that is necessary to make a complete job. Unless the payment item paragraph makes a specific exception of any item, incidental items will not be measured under any other item even though there is another listing for the work or material.

C. PAYMENT

Payment for all work specified, shown or incidental to complete the work will be made as follows:

Bid Item 0001 Remove and Dispose of the Existing Air Switches and Bus Support Insulators

Payment for Bid Item 0001 shall include all labor, material and equipment to remove and dispose of the existing air switches, bus support insulators, and all associated equipment and material including approximately 105 gallons of insulating oil. Disposal of all items shall be in conformance with the appropriate local, state and federal laws, codes, ordinances and regulations.

Bid Item 0002 Furnish and Install New Transformer Grounding Switches, 1200 Amp

Payment for furnishing and installing four (4) new manually operated transformer grounding switches 1200 amp; shall include the manufacturing, factory testing, delivering, and installing including all line connections additional auxiliary switches, modifications, adjustments, electrical tests and functional tests.

Bid Item 0003 Furnish and Install New Transformer Disconnect Switches, 1200 Amp Type MOD

Payment for furnishing and installing four (4) new transformer disconnect circuit switchers 1200 amp; shall include the manufacturing,

factory testing, delivering, and installing including all line connections additional auxiliary switches, modifications, adjustments, electrical tests and functional tests.

Bid Item 0004 Furnish and Install New Line Grounding Switches, 1600 Amp Type G

Payment for furnishing and installing two (2) new manually operated line grounding switches 1600 amp; shall include the manufacturing, factory testing, delivering, and installing including all line connections additional auxiliary switches, modifications, adjustments, electrical tests and functional tests.

Bid Item 0005 Furnish and Install New Line Disconnect Switches, 1600 Amp Type MOD-1

Payment for furnishing and installing two (2) new line disconnect switches 1600 amp; shall include the manufacturing, factory testing, delivering, and installing including all line connections additional auxiliary switches, modifications, adjustments, electrical tests and functional tests.

Bid Item 0006 Furnish and Install New Paralleling Bus Sectionalizer Switch, 1200 Amp Type MOD

Payment for furnishing and installing one (1) new Line Disconnect circuit switcher, 1600 Amp; shall include the manufacturing, factory testing, delivering, and installing including all line connections additional auxiliary switches, modifications, adjustments, electrical tests and functional tests.

Bid Item 0007 Furnish and Install New Bus Support Insulator Stacks.

Payment for furnishing and installing twenty four (24) insulator stacks with buss and line connections and shall include the manufacturing, factory testing, delivering, and installation. Installation shall include all support and line connections.

Bid Item 0008 Furnish Spare Parts

Payment for furnishing spare parts shall include delivering, FOB Big Bend Project a complete set of spare parts as described in page 107.

Bid Item 0009 Dispose of Asbestos Containing Material

Payment for proper removal and disposal of asbestos containing material and shall include proper waste shipment records.

Bid Item 0010 Furnish and Install Coupling Capacitor Voltage Transformers, CCVT's.

Payment for furnishing and installing six (6) CCVT's and shall include the manufacturing, factory testing, delivering, and installation.

PROMPT PAYMENT ACT

Pay request authorized in CONTRACT CLASUES clause: Prompt Payment Act. Contractor shall submit an original invoice and three copies (or electronic invoice, if authorized) to the address designated in the contract to receive invoices. The Government will make payment in accordance with the prompt payment act (31U.S.C. 3903) and OMB prompt payment regulations at 5 CFR Part 1315.

SECTION 16367

BIGDS0016367

HIGH VOLTAGE AIR SWITCH REPLACEMENT

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SECTION 16367

HIGH VOLTAGE AIR SWITCH REPLACEMENT

PART 1 GENERAL

1.1 SITE CONDITIONS

Big Bend Powerhouse is at 1420 feet, MSL. The ambient temperature ranges between -40°C and +40°C.

1.2 DESCRIPTION OF WORK

The work includes replacement of three pole, 240 kV, high voltage air switches and operators. The work site is the draft tube deck of the Big Bend Powerhouse. The switches are mounted on four, 33 foot high brackets and on three 60 foot high steel towers founded on the draft tube deck. The transformer disconnects will be replaced with motor operated circuit switcher disconnects capable of interrupting fault current and equipped with manually operated ground switches. Two of the transformer disconnects circuit switchers shall include coupling capacitor voltage transformers mounted on extended bases. The bus tie switch shall be replaced with a motor operated circuit switcher disconnect capable of interrupting fault current. The two line switches shall be replaced with motor operated line switch disconnects equipped with an SF6 interrupter capable of interrupting line & load current. The line switches shall have manually operated ground switches.

1.2.1 Demolition

Demolition work includes removal of the following, which become the property of the Contractor:

- a. Seven 240 kV motor operated switches.
- b. Four electric release, manual reset, high-speed grounding switches.
- c. Two manually operated grounding switches.
- d. Twenty-one oil interrupters, part of a. Each interrupter contains approximately five (5) gallons of insulating oil. Contractor is responsible for testing the oil for contaminants and for disposing of the oil in conformance with all applicable law, codes, ordinances and regulations.
- e. Switch actuators, operators, linkage and auxiliary switches.
- f. Low voltage power and control cables back to first termination.

1.2.2 Supply and Install.

- a. Replace the following switches with new switches as specified herein:

Switch No.	Application	Rating, Amp.	Type
1080	Transformer #1 Grounding	1200	HSG
1081	Transformer #1 Disconnect	1200	MOD

1083	Fort Thompson Line #1	1600	MOD-1
1090	Line #1 Grounding	1600	G
2080	Transformer #2 Grounding	1200	HSG
2081	Transformer #2 Disconnect	1200	MOD
3080	Transformer #3 Grounding	1200	HSG
3081	Transformer #3 Disconnect	1200	MOD
4080	Transformer #4 Grounding	1200	HSG
4081	Transformer #4 Disconnect	1200	MOD
4083	Fort Thompson Line #2	1600	MOD-1
4090	Line #2 Grounding	1600	G
7089	Paralleling Bus Sectionalizer	1200	MOD

G Manually operated grounding switch

HSG Electric release, manual open, fault-initiating grounding switch
To be replaced with manually operated ground switch

MOD Motor operated disconnect switch
To be replaced with motor operated disconnect/Circuit Switcher

MOD-1 Motor operated disconnect switch
To be replaced with motor operated disconnect Line Switch

b. The contractor shall replace 24 bus support insulator stacks (5 insulators per stack, Ohio Brass - Technical Reference No. TR175).

1.2.3 Design

Provide design and drafting services incidental to the switch replacement work. Requirements for these services are described in PART 3. Drawings to be produced include, but are not limited to the following:

- a. Record sketches of existing wiring and terminals.
- b. Sizing of cables and conductors, includes verifying raceway fill.
- c. New control schematics.
- d. New interconnection diagrams.
- e. Revisions to all plant operational drawings affected by the work.
- f. Structural steel details for adapting new switches to existing supporting structure. These include redesign to suit new switches, of anchorage points on the base of switches 1083, 4083 and 7089 for main paralleling bus strain insulators.

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C29.1 (1988; R 1996) Electrical Power Insulators - Test Methods

ANSI C29.9 (1983; R 1996) Wet-Process Porcelain Insulators
-Apparatus, Post Type

ANSI C80.1 (1994) Rigid Steel Conduit-Zinc Coated

AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)

ASTM A36 Rev A (1997; R 1999) Structural Steel

ASTM A123 Rev A (1997; R 1998) Zinc (Hot-Dip Galvanized)
Coatings on Iron and Steel Products

ASTM A153 (1998) Zinc Coating (Hot-Dip) on Iron and Steel
Hardware

ASTM A 500 (1999) Cold-Formed Welded and Seamless Carbon
Steel Structural Tubing in Rounds and Shapes

ASTM A 501 (1999) Hot-Formed Welded and Seamless Carbon
Steel Structural Tubing

ASTM B98 (1998) Copper-Silicon Alloy Rod, Bar, and Shapes

ASTM B188 (1996) Seamless Copper Bus Pipe and Tube

ASTM B221 (1996) Aluminum and Aluminum-Alloy Extruded
Bars, Rods, Wire, Profiles, and Tubes

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.1 (1989) Unified Inch Screw Threads (UN and UNR
Thread Form)

ASME B1.20.1 (1983; R 1992) Pipe Threads, General Purpose
(Inch)

INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)

IEEE C2 (1997) National Electrical Safety Code

IEEE C37.32 (1990; R 1996) High-Voltage Air Switches, Bus
Supports and Switch Accessories - Schedules of
Preferred Ratings, Manufacturing Specifications,
and Application Guide

IEEE C37.30 (1997) Definitions and Requirements for High-
Voltage Air Switches, Insulators, and Bus
Supports

IEEE C37.30 (1997) Required ratings and constructional
requirements for switches above 1000V

IEEE C37.34 (1994) Standard Test Code for High-Voltage Air
Switches

IEEE C37.35 (1995) Guide for the application, installation,
operation and maintenance of high-voltage air
switches and interrupter switches.

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION INC. (NETA)

NETA ATS (1999) Acceptance Testing Specifications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION PUBLICATIONS (NEMA)

NEMA FB 1 (1993) Fittings, Cast Metal boxes, and Conduit Bodies for Conduit and Cable Assemblies

NEMA ICS 1 (1993) Industrial Control and Systems

NEMA ICS 2 (1993) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC

NEMA MG 1 (1998; R 1999) Motors and Generators

NEMA WC 7 (1988; R 1996) Cross-Linked-Thermosetting-Polyethylene- Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NEMA WC 8 (1988; R 1996) Ethylene-Propylene-Rubber- Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

NESC C2 (2002) National Electric Safety Code

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation. Submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with SECTION H.

SD-01 Data

Equipment; GA

Within 30 calendar days after date of receipt of notice of award, Three (3) copies of manufacturer's data, drawings, catalog cuts, and wiring diagrams of all parts of the equipment. The information shall include, as a minimum, operating handles and locks, details of jaw and hinge contacts, bearings, operating rod guide bearings, methods of joining operating rod members, spring or motor operating mechanisms, auxiliary switches, and mechanical interlocks. Submittals shall include schematic and connection diagrams of the motor operating mechanism. Data shall be in sufficient detail to demonstrate that all moving parts of hinge connection are adequately protected from the weather and that no springs are part of the current carrying path. As a minimum, submittals shall be provided for the following components:

- a. Disconnect Switch/ Circuit Switchers
- b. SF6 Interrupter

- c. Grounding Switch
- d. Switch/Circuit Switcher Operators and Controls
- e. Switch/Circuit Switcher Linkages and Connectors
- f. Switch/Circuit Switcher Insulators
- g. Auxiliary Switches
- h. Auxiliary Relays
- i. Tubular Bus
- j. Bus Fittings and Connectors
- k. Nameplates

SD-04 Drawings

Disconnect Switch, Grounding Switch, Operators and Linkages; GA

Within 30 calendar days after date of receipt of notice of award, three (3) copies of outline drawings of all equipment to be furnished, together with weights, detail dimensions and completes mounting details. Drawings are primarily for design of the installation and shall be furnished with the following information:

- a. Outline drawings showing:
 - (1) Mounting dimensions.
 - (2) Location and dimensional data of terminals.
 - (3) Dimensional data pertaining to the arc of travel of disconnect and grounding switch blades.
 - (4) Plan and elevation for travel of energized parts during operation so clearances to walls, ground, etc., may be verified.
 - (5) Open-gap (metal-to-metal) distance.
 - (6) Total net weight of each single pole assembly less motor operator and less insulators and less interrupter. .
 - (7) Total assembled weight of each complete single pole assembly, including insulators and interrupter.
 - (8) Total projected surface area of each complete single pole assembly.
 - (9) Net weight of motor operator.
 - (10) Mounting details for the auxiliary switches.
- b. Outline drawings of the switch arrangement for each pole showing installation dimensions, including the operating mechanism.

c. A detailed wiring diagram showing both the internal and external connections, and a complete three-pole schematic diagram shall be furnished for the motor-operator control scheme and auxiliaries.

Operational Drawing; GA

Prior to final acceptance of the work, submit three (3) copies of the following operational drawings, prepared on Bentley Microstation. Drawings shall be accompanied by CD diskette(s) of the drawing files.

- a. Switch operator schematic diagrams.
- b. Switch operator wiring diagrams.
- c. Interconnection diagrams including:
 - (1) Switch operators
 - (2) Auxiliary switches
 - (3) Interlocks
 - (4) Existing switchboards
- d. Control switchboard wiring diagrams.
- e. Revised cable and conduit schedules.
- f. Revised conduit and grounding plans.

SD-06 Instructions

Operation and Maintenance Manuals; GA

Two weeks prior to delivery of switches: three (3) copies of the manufacturer's standard operation and maintenance manuals for disconnect switch, grounding switch, switch operators. Manuals shall contain the following information for the switch, motor and spring operators, and any accessory equipment included therewith:

- a. Complete instructions covering the operation, adjustment and maintenance of the equipment. Cuts or drawings shall be provided showing all points where adjustments may be made.
- b. Drawings which identify all spare parts by either part number or item and drawing number.
- c. Information and drawings on insulators provided with the switches.
- d. A detailed wiring diagram showing both the internal and external connections, and a complete three-pole schematic diagram shall be furnished for the motor-operator control scheme and auxiliaries.

SD-07 Schedules

Factory Tests; FIO

Four weeks prior to start of routine factory tests; submit a factory test schedule.

Construction Outages; GA

Within 30 days after date of receipt of notice of award, submit on schedule of outages required as specified in paragraph 3.1.3.

Accessories and Spare Parts Lists; GA

List shall be itemized and include the following data for each item:

- a. Quantity.
- b. Manufacturer.
- c. Part Number.
- d. Nomenclature or Description.
- e. Unit Price.

SD-09 Reports

Disconnect Switch/Circuit Switcher and Grounding Switch Design Test Reports; FIO

Within 30 calendar days after date of receipt of notice of award, three (3) certified copies of design test reports for tests specified. If the Contractor performs design tests specifically for equipment furnished under this contract, he shall submit three (3) certified copies of those design test reports within 30 days after approval of data package.

Disconnect Switch/Circuit Switcher and Grounding Switch Production Test Reports; FIO

Within 14 days after completion of tests, three (3) certified copies production test reports for equipment specified.

Insulator Production Test Reports; FIO

Tests shall be made at the place of manufacture and three (3) copies of certified test reports shall be furnished within 14 days after completion of tests. Witnessing of factory tests will not be required.

SF6 Interrupter Test Reports; FIO

Tests shall be existing design tests or shall be made by the manufacture. Three (3) copies of certified test reports shall be furnished within 14 days after completion of tests. Witnessing of factory tests will not be required.

Coupling Capacitor Voltage Transformer Production Test Reports; FIO
Within 14 days after completion of tests, three (3) certified copies production test reports for equipment specified.

1.5 QUALIFICATIONS

Each manufacturer shall have a minimum two (2) years experience with the production of equipment of the same type and rating. If the Contractor desires to deviate from the standards specified, he shall after award submit a statement of the exact nature of the deviation, and shall submit for the approval of the Contracting Officer complete specifications covering the materials and equipment proposed for use.

PART 2 PRODUCTS

2.1 OUTDOOR AIR DISCONNECT SWITCH/CIRCUIT SWITCHER & GROUNDING SWITCHES

2.1.1 General

The equipment to be furnished under this section consists of outdoor, three pole, group operated, vertical break disconnect switches. All disconnect switches shall be complete with terminal connectors; linkages; hardware; accessories; and necessary mounting devices, all as specified herein. The operating linkage shall be Contractor-designed, in coordination with the switch manufacturer for the existing structure. The switches shall be designed for mounting on the existing structures requiring none but minor modifications or additions to the structure.

2.1.1.1 Circuit Switchers.

Circuit switchers shall have horizontal interrupters with integral motor operated horizontal mounted vertical break disconnect switches suitable for the 240 kV transformer circuits. Each circuit switcher shall be provided with a shunt trip stored energy mechanism per phase located under each rotating insulator stack to provide high speed tripping. Shunt trip mechanisms shall be rated for 125 VDC operation. A single stored energy mechanism located at ground level is not acceptable.

2.1.1.2 Line Switches,

Line Switches shall be suitable for the 240kV transmission line circuit and shall be equipped with an SF6 interrupter mounted on the jaw end.

2.1.2 Operating Conditions

The switches shall operate satisfactorily in both directions in an 80 miles per hour wind or with 3/4 of an inch accumulation of ice on any or all parts of the mechanism or contacts.

2.1.3 Support Structure

Switches shall be mounted on existing structures. All fasteners shall be NC or UNC series in accordance with ASME B1.1. Pipe fittings and threads shall be in accordance with ASME B1.20.1.

2.1.4 Hardware

Fasteners and pins used in the assembly of non-ferrous parts shall be either silicon bronze conforming to ASTM B98, alloy B; or nonmagnetic stainless steel.

Other corrosion-resistant metals may be substituted, with prior approval of the Contracting Officer.

Energized parts shall be free from points or sharp edges or shall be adequately shielded against corona discharge.

2.1.5 Galvanizing

Galvanizing shall be in accordance with ASTM A123 or A153 as applicable. The zinc-iron alloy formed at the interface shall not exceed 70% of the thickness of the zinc layer.

2.1.6 Rating

The ratings of the switches shall be as indicated below and shall conform to the requirements of ANSI C29.9, C37.32 and IEEE C37.30.

a. Rated Maximum Voltage, kV rms	242
b. Basic Impulse Insulation Level, kV Crest	900
c. Continuous Current Rating, Amperes, rms	as described in PART 1
d. Momentary Asymmetrical Current Rating, kA, rms	ANSI C37.32
e. Three second current rating	ANSI C37.32 Table 1
f. Grounding switch making current, kA, rms	61

2.1.7 Line Switch / Circuit Switcher Bases

Bases shall be fabricated from structural steel conforming to the requirements of ASTM A36. Each single-pole switch element shall be assembled on an individual base. The base shall be designed as a rectangular or square enclosed tube in cross section to prevent excessive torsional deflection during high wind loading. The tubes may be structural tubes conforming to ASTM A500 or A501 and The Manual of Steel Construction Allowable Stress Design, Ninth Ed. Of AISC or may be fabricated from steel plates and shapes and shall conform to the provisions of SECTION 05101 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS. The bases shall be constructed so that the deflection under maximum operating force with maximum wind loading will not interfere with the successful operation of the switch. Bases shall be hot dip galvanized after fabrication. Field damage to galvanizing shall be repaired in accordance with SECTION 05101.

2.1.8 Switch Blades

Blades shall be of tubular construction designed to withstand operation under the weather and ice conditions specified and to provide maximum strength with minimum weight. They shall be sufficiently rigid to prevent whip or vibration and of a design that will tend to minimize an accumulation of ice, or foreign matter. The blades shall automatically lock when in the closed position to prevent opening due to vibration or electromagnetic forces. Blades shall be counter-balanced for ease of operation and smooth control.

2.1.9 Switch Contacts

All live switch contacts shall be of the high-pressure type. In opening, contact pressure shall be released prior to vertical motion of

the blade, and in closing, pressure shall be applied after vertical motion has ceased. Contacts shall be self-cleaning and designed so that the wiping action will not cause scarring or abrasion of the contact surfaces. For contact surfaces of silver, the silver shall be at least 10 mils thick. Fixed guides shall be provided for proper seating of contacts with a blade out of line one-inch in any direction.

2.1.10 Hinge Connections

The current-carrying path through the hinge mechanism of the switches shall be by means of movable pressure type contacts of proven design. The entire hinge mechanism of the switch shall be designed and constructed to prevent nesting of birds or insects from interference with proper operation of the switch.

2.1.11 Terminals

Switch terminal pads shall be of high-strength aluminum alloy or high-copper alloy with silver-plated contact surfaces. Terminal connectors of high-copper alloy shall be provided at each end of each switch. The contact surfaces of the terminal connectors connecting to the terminal pads of the switches shall be silver-plated. The terminal pads shall be NEMA six hole type per ANSI C37.32 Figure 1 (c) able to accommodate NEMA two or four hole connections. Terminal loading shall meet the requirements of ANSI C37.32 Table 2.

2.1.12 Switch Bearings

Bearings shall be of ample size to sustain the imposed loads and of a type to ensure continued ease of operation and long life. Bearings provided at the base of the rotating insulator column shall be of the ball or roller type and shall be adequately protected from the weather to prevent the entrance of dirt or moisture and resulting corrosion. All bearings shall maintain proper alignment, ensure continued ease of operation, and ensure against corrosion and seizing under conditions specified. Gears shall be enclosed in weatherproof cases designed to retain the necessary lubricant. All line and transformers switches shall have bearings at the base of each rotating insulator stack and, if necessary, additional bearings at the top of the stack.

2.1.13 Actuator Shafts

Vertical shafts or pipes connecting the switch operator to the switch pole shall be provided with intermediate bearings spaced to prevent displacement or binding of the connecting shaft. Bearings shall be of a design that avoids relative motion between the surface of the shaft or pipe proper and the stationary part of the bearing. Thrust bearings shall be provided to permit ready operation of the switch actuator decoupling mechanism.

2.1.14 SF6 Gas Interrupter

The interrupters shall be single gap type using SF6 gas puffer interruption technology. These interrupters shall be rated for use over an ambient temperature range of -40 degrees C to +40 degrees C and shall be provided with a color coded pressure gauge, an overpressure relief device, and a gas fill valve. Hermetically sealed interrupters are not acceptable.

2.1.14.1 Circuit Switcher Interrupters.

Circuit switcher interrupters shall be shipped with a positive pressure of 5-10 psi of SF6, eliminating the need to pull a vacuum on the interrupter in the field. The Contractor shall top off each interrupter to rated pressure after installation. Circuit switchers shall open the interrupter before the disconnect switch blade opens and shall close after the disconnect blade closes, thus making and breaking the circuit in an SF6 environment. Circuit switchers which make the circuit on the switch blade are not acceptable. Circuit Switchers shall have the following interrupting capability:

Primary fault current, kA, rms	20
Secondary fault current, (transformer thru fault rating), kA, rms	4
Interrupting time, cycles	6

2.1.14.2 Line Switch Interrupters.

Line switch interrupters shall be inserted in the circuit during the opening operation only. Closing the circuit shall be done on the disconnect switch blade. Heavy duty load making arcing horns shall be furnished to prevent arcing on the main current carrying blade and jaw contacts. Interrupters shall be rated for loop and load breaking current of 2000 amperes and line charging current of 200 amperes.

2.1.15 Switch Position Indicator

A mechanical device to indicate the "OPEN" or "CLOSED" position of the switch blades shall be located approximately at eye level.

2.1.16 Padlocking Provision

Provide a means for padlocking each operating mechanism in either the open or closed position.

2.1.17 Switch Operator Isolation

A positive means shall be provided for decoupling the switch operator from the vertical operating shaft. This means shall include a visible gap, located approximately at eye level, between the vertical operating shaft and the switch operator. This isolation shall be effective with the switch either open or closed and shall be capable of being padlocked in the disengaged position. Re-engagement shall be possible only with the switch operator in the same relative operating position as the switch blades.

Provide a flexible braid copper grounding conductor, with a cross-section area equal to 4/0, across the isolation mechanism.

2.1.18 Interphase Linkage

Linkage shall be continuous lengths between switch poles. Forces shall be transmitted independent from pipe threads. Line and bus tie switches 1083, 4083 and 7089 shall be provided with push-pull type linkage to balance the lateral forces imposed on the switch poles and minimize deflections imparted to the switch base.

2.1.19 Interlocking

Interlocking shall be provided as specified below and shown on the contract drawings. The grounding switch operating mechanism shall be electrically interlocked with the disconnect switch mechanism to prevent the closing of the disconnect switch when the grounding switch is in the closed position. The Contractor shall provide required auxiliary switches.

2.1.20 Manual Operators

The geared type manual operators shall drive a worm or bevel gear operated with a crank. The motion of the handle shall be clockwise to close and counterclockwise to open the switch. All gears and worms shall be lubricated and completely enclosed in gear cases. The nondetachable crank shall be not more than 15 inches nor less than 12 inches in length. A rain tight shield shall be provided where the vertical shaft extends through the gear case. All gear-operating mechanisms shall be enclosed in weather proof cases made of corrosion-resistant metal, or metal hot-dip galvanized in accordance with ASTM A153. All cases shall be designed to retain the necessary lubrication, shall be fitted with a drain hole and captive plug in the bottom, and shall be provided with pressure fittings if parts require periodic grease lubrication.

2.1.21 Motor Operator

A rotational output motor operating mechanism shall be provided to reset the opening and closing springs and to open and close the vertical break disconnect switch blades. Reciprocating output operating mechanisms are not acceptable. The motor operating mechanism shall be rated for use at 125 VDC and shall be provided with local open-close pushbuttons. The controls shall include a local-remote selector switch and terminal blocks to accommodate connection to remote switches and position indicating lights. A twelve stage auxiliary switch with eight stages available for customer wiring shall be included. The operating mechanism shall be equipped with a thermostatically controlled 120 VAC heater, heater circuit protection, operations counter, pullout fuses for motor and control circuits, and internal cabinet light with toggle switch. A manual crank handle operator shall be provided; insertion of manual crank handle shall automatically disconnect the motor circuit. A suitable hanger with fastening devices shall be provided to hold the crank when not in use. Motor operator shall include a decoupler for the vertical pipe and front and right side door access. The motor operating mechanism shall operate from full open to full closed in not greater than 8 seconds and from full closed to full open in not greater than 8 seconds and shall generate not less than 32,000 inch-pounds of output torque. The operating mechanism shall be capable of being padlocked in both the open and the closed positions. The ability to recouple in an incorrect position shall be positively prevented. The motor shall conform to applicable requirements of NEMA MG 1 and controls shall comply with NEMA ICS 2. The gear train shall be designed for quiet operation and shall be totally enclosed. Reversing contactors shall be mechanically interlocked. Contactors shall be NEMA Size 1 or larger with operating coils suitable for continuous operation at rated voltage. A mechanical brake with electric release or other positive means to stop the operation of the disconnect and to hold it in the open or closed position shall also be included.

a. D.C. Motor

The motors shall be of ball bearing type suitable for operation on 125-volt direct current and shall operate the switch satisfactorily at 5 percent overvoltage and 25 percent undervoltage for closing and opening. The motor shall be protected with overloads, sized as required. Motor shall have molded case circuit breaker with magnetic trip unit for use as a disconnect means within the enclosure.

b. Motor Operator Control

The local motor operator control shall be a two-button, momentary contact, "OPEN-CLOSE" push-button station or a switchboard type control switch, accessible only when the housing door is open. The controls shall also include indicator lights visible when the housing door is closed and an emergency stop button. The controls shall be a heavy-duty type rated 600-volts ac, 250-volts dc, 20 amperes continuous, with single-break inductive load interrupting rating of not less than 1.5 amperes for 125-volts dc. Controls shall include a means for visibly disconnecting the control voltage power supply. The motor operator shall include provisions for remote operation from the control room with existing "OPEN-CLOSE" handle and indicating lights. Motor operator shall include a "LOCAL-REMOTE" switch transferring control to the existing remote operating station at the control room.

c. Motor Limit Switches

Motor limit switches shall be heavy-duty snap-action type and shall have sufficient contacts to provide the specified control functions. "Open" and "closed" shall accurately indicate the point during the main switch operating cycle when each blade reaches the end of its stroke and has successfully attained its fully open or fully closed limit position. The limit switches shall positively hold their adjustment setting under all ambient operating conditions, in severe dust locations, and over indefinite periods of time to assure maximum integrity of position indication. Each limit switch shall be easily adjustable and easily accessible. Each limit switch shall be electrically independent.

d. Motor Operator Housing

Motor operator housing shall be deadfront with means for locking with a padlock when closed. The housing shall be drilled and tapped for the entrance of conduits. The housing shall include a 120-volt, single-phase, ac heating unit of approximately 100 watts capacity, with an automatic thermostat control and a molded case circuit breaker or switch to disconnect the heating unit from the source of power. Doors shall provide easy access to all parts. Suitable screened louvers with dust filters shall be provided for ventilation, and a drain with dust filter shall be provided to prevent accumulation of moisture at the bottom of the housing.

e. Terminal Blocks

Sufficient terminal blocks shall be provided in the motor operator for connection of the external wiring including all auxiliary switches and a minimum of ten percent spare terminals, but in no case shall fewer than four spare terminals remain after completed installation. They shall be of molded or fabricated type with barriers, rated not less than 600-volts, 30 Amp. The terminals shall be removable, binding, fillister, or washer-head screw type terminals, or stud-type with contact and locking nuts. They shall be not less than No. 10 in size

suitable for connecting at least two No. 10 AWG conductors, with indented terminal connectors, to one terminal. Wiring shall be complete between all equipment within the housing and the terminal blocks. Terminal block marking strips shall be provided, suitably marked with wire designations. These markings shall be added to the Contractor's - shop drawings. External cable designations will also be furnished to the Contractor for adding to the shop drawings.

f. Wiring

Insulated wire shall have minimum rated circuit voltage of 600 volts in accordance with Table 3-1 of NEMA WC 7 or NEMA WC 8. All wires shall be single-conductor, of stranded, annealed copper. Conductors shall be Class B or Class C stranding, except for hinge wire which shall be Class H or Class K stranding. Conductor size shall be not less than No. 14 AWG. Insulation shall be cross-linked thermosetting polyethylene (XLPE) type, meeting the requirements of Section 3 or paragraph 7.7 of NEMA WC 7 as applicable, or an ethylene-propylene rubber (EPR) type meeting the requirements of Part 3 of NEMA WC 8. All connections to device terminals studs or blocks shall be made with ring tongue terminals. Ring tongue wiring external to the switch operators shall be in galvanized rigid steel conduit as specified in SECTION 16050. The completed installation shall conform to the requirements of the National Electrical Code, NFPA 70.

g. Wire Markings

All control conductors shall be identified with nonmetallic tube-type markers at each termination. Markers shall be suitable for the type of wire insulation. Tubing shall be sized to fit the wire being marked and shall have black marking on a light colored background. Installed markers shall be uniform in position on the wire and legends shall be visible when wires are terminated on blocks or at equipment. Written certification from an approved independent testing laboratory shall be furnished to indicate that the markers will not stain or discolor after 20 years' service when subjected to an accelerated aging test while in contact with wire insulating materials. Identification on markers shall be as shown on the shop drawings or as directed.

2.1.22 Not Used

2.1.23 Switch Insulators

The equipment consists of post type insulators, and mounting bases conforming to the requirements of ANSI C29.9, and as shown on the drawings.

a. Porcelain and Glazing

The porcelain shells shall be clean, dense, homogeneous and nonporous, and shall be fired to a complete and uniform vitrification, free from internal stresses, cracks, blisters, laminations, voids, foreign matter, flaws, or other defects. The surfaces, except those roughened for cement grips, shall be smooth and shall be free from undue warping. The glaze shall be smooth, hard, dense, continuous, and brilliant. Surfaces of the porcelain shell subjected to mechanical stresses transmitted from the metal parts shall be sanded. The particles forming this sanded surface shall be of the size best adapted to the particular dimension and size of insulator and shall form a uniform single layer, smoothly distributed and firmly vitrified to the porcelain during the firing

process. No excess or loose particles shall be present after firing. The sanded zones shall be of uniform width and accurately located so as to properly distribute the mechanical loading, and shall be completely covered by metal parts. The caps and bases of the insulators shall be free from cracks, shrinks, air holes, burrs, or rough edges.

b. Metal Parts

The metal parts shall be so designed as to transmit the mechanical stresses uniformly to the porcelain. The contours of the metal and porcelain parts shall minimize areas or points of high dielectric flux concentration. All surfaces shall be smooth with no projecting points or irregularities that may cause corona.

2.1.24 Auxiliary Switches

Auxiliary switches shall be provided for functions as shown on the drawings. Contacts shall be rated 125 volts dc, and not less than 15 amperes continuous. All auxiliary switches shall be adjustable for timing with the switch blades and shall be complete with all connecting links and fittings. Failure of any switch pole to complete its operation shall not result in a false indication through the auxiliary switch. Terminal blocks shall be provided in the auxiliary switches for external wire connections. Auxiliary switches shall be directly connected to linkage and keyed to prevent slippage. Provide two spare "a" contacts and two spare "b" contacts on each switch.

2.1.25 Key Interlocks

Key interlocks for line switches and line grounding switches and for transformer switches and grounding switches shall be Kirk Key Interlock Company Scheme No. 4. Keys shall duplicate existing. Provide auxiliary switches as shown on the Drawings.

2.1.26 Switch Tools And Accessories

The Contractor shall furnish one complete set of all special tools, wrenches, and other appurtenant equipment that may be necessary or convenient for assembling, aligning or disassembling the switches.

2.1.27 Line Switches

Line switches include switch numbers 1083 and 4083. They shall be provided with the following as specified in paragraph 2.1.1.

- a. Motor operators.
- b. Auxiliary switches.
- c. Key interlocks.

2.1.28 Bus tie switch 7089 shall be provided with the following as specified in paragraph 2.1.1.

- a. Motor operators.
- b. Auxiliary switches.

2.1.29 Transformer switches include switch numbers 1081, 2081, 3081 and 4081. They shall be provided with the following as specified in paragraph 2.1.1.

- a. Motor operators.
- b. Auxiliary switches.
- c. Base Extensions. The base for each pole of switches 1081 and 4081 shall be extended to accept the blade side installation of a coupling capacitor voltage transformer.

2.1.30 Line Grounding Switches

Line grounding switches include switch numbers 1090 and 4090. They shall be provided with the following as specified in paragraph 2.1.1.

- a. Manual operators.
- b. Auxiliary switches.
- c. Key interlocks.

2.1.31 Transformer Grounding Switches

Transformer grounding switches ~~are fault initiating, high speed grounding type. The~~ include switch numbers 1080, 2080, 3080 and 4080. They shall be provided with the following as specified in paragraph 2.1.1.

- a. Manual operators.
- b. Auxiliary switches.
- c. Key interlocks.

2.1.32 Spare Parts

All spare parts shall be of the same material, and manufacture as the original parts, and they shall be interchangeable therewith. Parts shall be in clearly identified individual packages suitable for long term storage. The following spare parts shall be furnished:

- a. Three (3) complete assemblies of stationary and moving shoes, or tip assemblies, for main contacts of one pole of each rating of the disconnect switch.
- b. Three (3) complete assemblies of stationary and moving shoes, or tip assemblies, for one pole of one grounding switch of each rating.
- c. One (1) complete set of auxiliary contacts and springs for the disconnect and grounding switches.
- d. Three (3) switch insulator units of each size and rating.
- e. One (1) motor of each rating for the motor-operating mechanism.
- f. One (1) motor reversing contactor of each rating.
- g. One (1) set of limit switches of each rating.

- h. One (1) coil for electric brake release.
- i. One (1) motor contactor.
- j. One (1) Interrupter mechanism of each type

2.2 INSTALLATION MATERIALS

2.2.1 Anchor Bolts

Contractor shall furnish and install concrete expansion anchors, size and quantity as required. The anchors shall be made of high tensile and shear strength steel, with one-piece stainless steel expander mounted on parabolic wedge. Anchor shall be double plated. Plating shall be zinc with chromate dip conforming to Federal Specifications QQ-Z-325. Pull out values shall meet or exceed those listed under GSA FF-S-325.

2.2.2 Insulated Wire and Cable

2.2.2.1 All wire and cable used for power, control, indication, and relaying systems shall be provided by the Contractor and shall conform to the requirements specified herein. Characteristics, including conductor size, stranding, number of conductors, rated circuit voltage, cabling, and other requirements for each type of service, shall be as indicated on the drawings, or as specified under the detailed requirements of these specifications for the particular construction or use, unless otherwise stated. Complete descriptive specifications, test reports and drawings shall be submitted for approval for all items furnished.

2.2.2.2 Governing Standards

Materials, construction and tests, unless otherwise specified, shall conform to the applicable requirements of NEMA WC 7 and NEMA WC 8.

2.2.2.3 Rated Circuit Voltages

Wire and cable for circuits operating at 600 volts and below shall have minimum rated circuit voltages in accordance with Table 3-1 of NEMA WC 7 or WC 8.

2.2.2.4 Conductors

a. Material

Conductors shall conform to all the applicable requirements of Section 2 of NEMA WC 7 or Part 2 of WC 8 as applicable, and shall be annealed copper. Copper conductors may be bare, or tin- or lead-alloy coated, if required by the type of insulation used.

b. Size

Minimum wire size shall be No. 12 AWG or No. 19/25 for power and lighting circuits; No. 10 AWG or No. 19/22 strand current transformer secondary circuits; No. 14 AWG for potential transformer, relaying and control circuits.

c. Stranding

Conductor stranding classes cited herein shall be as defined in Appendix L of NEMA WC 7 or WC 8, as applicable. Any conductors used between stationary and moving devices, such as hinged doors or panels, shall be Class H or K stranding. All other conductors shall have class B or C stranding, except that conductors shown on the drawings, or in the schedule, as No. 12 AWG may be 19 strands of No. 25 AWG, and conductors shown as No. 10 AWG may be 19 strands of No. 22 WG.

2.2.2.5 Insulation

a. Insulation Material

Insulation shall be cross-linked thermosetting polyethylene (XLPE) type, meeting the requirements of Section 3 or paragraph 7.7 of NEMA WC 7 as applicable, or an ethylene-propylene rubber (EPR) type meeting the requirements of Part 3 of NEMA WC 8.

(1) The insulation material and its manufacturing, handling, extrusion and vulcanizing processes, shall all be subject to strict procedures to prevent the inclusion of voids, contamination, or other irregularities on or in the insulation. Insulation material shall be inspected for voids and contaminants. Inspection methods, and maximum allowable void and contaminant content shall be in accordance with Section B of AEIC CS5 or AEIC CS6, as applicable.

(2) Cables with repaired insulation defects discovered during factory testing, or with splices or insulation joints, are not acceptable.

b. Insulation Thickness

The insulation thickness for each conductor shall be based on its rated circuit voltage.

(1) Power Cables/Single-Conductor Control Cables, 2,000 Volts and Below.

The insulation thickness for single-conductor cables rated 2,000 volts and below shall be as required by Table 3-1, Section 3 of NEMA WC 7 or Table 3-1, Part 3, of NEMA WC 8, as applicable. Column "A" thickness of Table 3-1 of NEMA WC 7 will be permitted only for single-conductor cross-linked thermosetting polyethylene insulated cables without a jacket. NEMA WC 8 ethylene-propylene rubber-insulated conductors shall have a jacket. Column "B" thickness shall apply to single-conductor cables that require a jacket and to individual conductors of multiple-conductor cables with an overall jacket.

(2) Multiple-Conductor Control Cables

The insulation thickness of multiple-conductor cables used for control and related purposes shall be as required by Table 7-32 of NEMA WC 7 or Table 7.5.1 of NEMA WC 8 as applicable.

2.2.2.6 Jackets

All cables shall have jackets meeting the requirements of Section 4 of NEMA WC 7, or Part 4 of NEMA WC 8, as applicable, and as specified herein. Individual conductors of multiple-conductor cables shall be required to have jackets only if they are necessary for the conductor to

meet other specifications herein. Jackets of single-conductor cables and of individual conductors of multiple-conductor cables, except for shielded cables, shall be in direct contact and adhere or be vulcanized to the conductor insulation. Multiple-conductor cables and shielded single-conductor cables shall be provided with a common jacket, which shall be tightly and concentrically formed around the core. Repaired jacket defects found and corrected during manufacturing are permitted if the cable, including the jacket, afterward fully meets these specifications and the requirements of the applicable standards.

a. Jacket Material

The jacket shall be one of the materials listed below, in accordance with the paragraphs cited in parentheses below, of NEMA WC 8. Polyvinyl chloride compounds will not be permitted. Variations from the materials required below will be permitted only if approved for each specific use, upon submittal of sufficient data to prove that they exceed all specified requirements for the particular application.

- (1) Heavy-duty black neoprene (4.4.3).
- (2) Heavy-duty chlorosulfonated polyethylene (4.4.10).
- (3) Heavy-duty cross-linked (thermoset) chlorinated polyethylene (4.4.11).
- (4) PVC jackets will not be accepted.

b. Jacket Thickness

The minimum thickness of the jackets at any point shall be not less than 80 percent of the respective nominal thickness specified below:

(1) Multiple-Conductor Cables. Thickness of the jackets of the individual conductors of multiple-conductor cables shall be as required by Section 4, Table 4-6 of NEMA WC 7 or Part 4, Table 4-4 of NEMA WC 8, and shall be in addition to the conductor insulation thickness required by Column B of Table 3-1 of the applicable NEMA publication for the insulation used. Thickness of the outer jackets or sheaths of the assembled multiple-conductor cables shall be as required by Section 4, Table 4-7, of NEMA WC 7 or Part 4, Table 4-5, of NEMA WC 8.

(2) Single-Conductor Cables. Single conductor cables, if nonshielded, shall have a jacket thickness as specified in Section 4, Table 4-4 of NEMA WC 7 or Part 4, Table 4-2 of NEMA WC 8. If shielded, the jacket thickness shall be in accordance with the requirements of Section 4, Table 4-5 of NEMA WC 7 or Part 4, Table 4-3 of NEMA WC 8.

2.2.2.7 Identification

a. Color Coding. Insulation of individual conductors of multiple conductor cables shall be color coded in accordance with paragraph 5.3 of NEMA WC 8, except that colored braids will not be permitted. Only one color-code method shall be used for each cable with Table K-2, Appendix K of NEMA WC 8. Power cable color-coding for 208Y/120 volt service shall be black for Phase A, red for Phase B, blue for Phase C, white for grounded neutral, and green for an insulated grounding conductor, if included. Power cable color-coding for 480 volt circuits shall be brown for Phase A, orange for Phase B, and yellow for Phase C.

b. Cable Tags. All multiple-conductor cables shall be clearly identified with the cable designation by either embossed one-inch diameter brass tags or by embossed aluminum band markers.

c. Wire Tube-Type Markers. Wires and individual conductors of control and power cables shall be identified with non-metallic tube-type markers at each termination. Tube-type markers shall be suitable for contact with rubber or neoprene or plastic. A written certificate from an approved independent testing laboratory shall be furnished to indicate that the markers will not stain or test while in contact with wire insulating materials.

2.2.2.8 Cabling

Individual conductors of multiple-conductor cables shall be assembled with flame and moisture-resistant fillers, binders, and a lay conforming to Part 5 of NEMA WC 8, except that flat twin cables will not be permitted. Fillers shall be used in the interstices of multiple conductor round cables with a common covering where necessary to give the completed cable a substantially circular cross section. Fillers shall be of a non-hygroscopic material, compatible with the cable insulation, jacket, and other components of the cable. The rubber of a cable and filled or other approved type of binding tape shall consist material that is compatible with the other components of the shall be lapped at least 10 percent of its width.

2.2.2.9 Dimensional Tolerance

The outside diameters of single-conductor cables and of multiple conductor cables shall not vary more than 5 percent and 10 percent, respectively, from the manufacturer's published catalog data.

2.2.2.10 Inspection and Tests

Inspection and tests of wire and cable furnished under these specifications shall be made by and at the plant of the manufacturer, and shall be witnessed by the GQAR, unless waived in writing. Five certified copies of the reports of all tests shall be furnished including all test data. Reports of all witnessed tests shall be signed by the witnessing Contractor Quality Control Representative and GQAR. The costs of performing all tests shall be borne by the Contractor and shall be included in the prices bid in the Schedule of Section B. The Government may perform further tests before or after installation. Testing in general shall comply with Section 6 of NEMA WC 7 or Part 6 of WC 8. Specific tests required for particular materials, components, and completed cables shall be as specified in the sections of the above standards applicable to those materials, components, and cable types. Tests shall also be performed in accordance with the additional requirements specified below.

a. High-Voltage Test Source. Where applicable standards allow a choice, high-voltage tests for cables to be used exclusively on dc circuits shall be made with dc test voltages. Cables to be used exclusively on ac circuits shall be tested with ac test voltages. if both ac and dc will be present, on either the same or separate conductors of the cable, ac test voltages shall be used.

b. Flame Tests. All multiple-conductor and single-conductor cable assemblies shall pass the IEEE 383 flame tests, paragraph 2.5, using the ribbon gas burner. Single-conductor cables and individual conductors of

multiple-conductor cables shall pass the flame test of NEMA WC 7, paragraph 7.7.3.1.3. If such tests, however, have previously been made on identical cables, these tests need not be repeated. Instead, certified reports of the original qualifying tests shall be submitted.

c. Independent Tests. The Government may at any time make visual inspections, continuity or resistance checks, insulation resistance readings, power factor tests, or dc high-potential tests at field test values. A cable's failure to pass these tests and inspections, or failure to produce readings consistent with acceptable values for the application, will be grounds for rejection of the cable.

2.2.2.11 Packaging and Marking

The cables shall be furnished one length to a reel or coil. Each length, and the outside of each reel or coil, shall be plainly marked or tagged to indicate the cable length, voltage rating, conductor size, and manufacturer's lot number and reel number. Cables for exclusively dc applications shall be identified as such. Reels shall remain the property of the Contractor.

2.2.2.12 Terminations

There shall be no splices in the wiring and all connections shall be made at terminal studs or terminal blocks with ring-tongue indented terminals, Burndy Type YAV or YA.E, T&B STA-KON, or approved equal. All screw terminals shall have toothed lockwashers and all stud terminals shall have contact nuts and either locking nuts or lockwashers.

2.2.3 Conduit and Fittings

Conduit shall be rigid steel conforming to ANSI C 80.1 and shall be zinc coated both inside and outside by the hot-dip method. Fittings for ridged metal conduit shall be galvanized malleable iron or cast aluminum conforming to the requirements of NEMA FB 1 and shall employ fasteners made from corrosion resisting material.

2.2.3.1 Conduit Sealing Bushings

Conduit sealing bushings used in core bit drilled concrete penetrations shall be OZ/Gedney Type CSM. Seals for abandoned conduits shall be OZ/Gedney Type CSB.

2.2.4 Line Terminations

Transition plates for bolted connections between aluminum and copper-based alloy connectors shall be Anderson type TP, or approved equal. Joint compound for making up bolted aluminum conductor fittings shall be Anderson VERSA-SEAL #155, Alnox or approved equal.

2.3 Coupling Capacitor Potential Transformers

A set of three (3) Coupling Capacitor Voltage Transformers, CCVTs, shall be installed on each switch 1081 and 4081. CCVTs shall conform to the requirements of ANSI C93.1 and C93.2 and shall be suitable for base mounting on the switch/circuit switcher provided under this contract. CCVTs shall have sufficient mechanical strength to withstand, without damage, repeated winds of 100 mph and non-simultaneous earthquake accelerations of 0.2G in any direction. The oil filled part of the coupling capacitor voltage transformer shall be completely factory

sealed to prevent breathing and absorption of moisture. The base housing shall be weatherproof. All porcelain shall be wet process, homogenous, and free from cavities or other flaws. The glazing shall be uniform in color and free from blisters, burns, and other defects. Flanged segments shall connect multiple piece porcelain parts. Each CCVT shall include a potential grounding switch between the capacitor divider intermediate voltage circuit and ground. The switch shall be hook stick operable from ground elevation without opening the housing of the unit. Terminal connection shall be NEMA standard suitable for connection to existing switch and 230kV bus via conductor.

2.3.1 Ratings: Each voltage transformer shall have

Type: Single Phase, outdoor, 60Hz
Nominal System Voltage: 230kV
Maximum System Voltage 242kV
BIL: 900kV
Ratio: 1200:1 and 1200:1
ANSI Accuracy Rating: 0.3% Metering Accuracy
Number of Secondary Windings: 2 - Rated 115/66.4V
Output: 200VA ea. winding
Thermal Burden at 30°: 200VA
Porcelain Color: to match switch/circuit switcher

2.3.2 Tests. Each CCVT shall be provided with certified test results in accordance with ANSI C93.1 and C93.2. Production tests shall include, capacitance & dissipation factor, Dielectric, Accuracy, polarity, protective gap setting.

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

3.1.1 Draft Tube Deck

Contractor occupancy of draft tube deck shall permit unrestricted access by plant operating personnel. The Contractor shall cooperate with operating personnel in ensuring rapid access of crane or mobile equipment in an emergency. The gantry crane shall have access to any draft tube for stop log operations on four hours notice.

3.1.2 Power House Roof

Contractor shall have minimal access to powerhouse roof. Mobile equipment is not permitted. Roof shall be protected in work areas with 2 courses of 3/4" plywood, half-lapped.

3.1.3 Scheduling

Contractor shall schedule his outages to minimize loss of production. His schedule shall be arranged to permit operation of half the units during most of the construction period, minimizing the total time requiring all units to be down.

3.2 CLEARANCE

Contractor shall receive clearance from both WAPA and Big Bend Power Plant prior to grounding either of the Fort Thompson lines. He shall receive clearance from Big Bend prior grounding a transformer bus. All grounding shall be installed and maintained by the Contractor, in conformance with all safety codes and requirements, independent from existing grounding switches.

3.3 FACTORY TESTS

3.3.1 Routine Test

Each item of equipment shall be given the manufacturer's routine factory tests and other tests specified below. The factory test equipment and the test methods used shall conform to the applicable requirements of ANSI Standards, IEEE Standards, and NEMA Publications and are subject to the approval of the Contracting Officer. All tests required will be witnessed by the Contracting Officer unless waived in writing, and no equipment shall be shipped until it has been approved for shipment by the Contracting Officer. The Contractor shall notify the Contracting Officer a minimum of 2 weeks in advance of the date of the tests so that arrangements can be made for the Contracting Officer's Representative to be present at the tests. The cost of performing all tests shall be borne by the Contractor.

3.3.2 Group-Operated Disconnect Switch/Circuit Switcher and Grounding Switch Design Tests

The Contractor shall perform all applicable design tests on one switch of each rating unless design tests specified by IEEE C37.34 have previously been made on switches of identical construction and of the same voltage, continuous current and momentary current ratings as those specified, in which case the Contractor may furnish certified copies of these design tests in lieu of making the tests. Tests made by the Contractor on the equipment to be furnished shall be made on one completely assembled pole of one of each rating of disconnect and grounding switch. Switch insulators required for making the tests shall be furnished by the Contractor. If any switch fails to pass all of the specified tests, then all switches of the same rating shall be tested. Any switch which fails to pass all of the specified tests will be rejected. Tests shall be performed in accordance with the applicable provisions of IEEE C37.34.

3.3.3 Group-Operated Disconnect Switch/Circuit Switcher Routine Production Tests

All tests will be witnessed by the Contracting Officer, unless waived in writing, and no equipment shall be shipped until it has been released for shipment by the Contracting Officer:

a. Each single-pole of the disconnect switch shall be assembled without insulators, inspected and given the manufacturer's routine production and operating tests. Tests shall be performed with switch mounted in a position as shown on the drawings. Factory adjustment shall be so made that field changes will not be required on the switch beyond the point where interphase connections are attached to the rotating insulators.

b. All parts shall be properly marked and identified for ease of field assembly.

c. Dimensions in accordance with the applicable contract and manufacturer's drawings shall be verified.

3.3.4. Operating Mechanisms

The following tests shall be made on the motor operator to be furnished:

a. Inspection and operation tests on each electrical operating mechanism. The completely assembled motor-operator shall be given electrical operational tests to verify electrical connections, operation free of misalignment or binding, and satisfactory overall assembly and performance.

b. Dielectric test on each motor in accordance with NEMA MG 1.

c. Dielectric test on the control equipment for each motor in accordance with NEMA ICS 1.

3.3.5 Insulators

The following tests shall be made on insulators of each specified rating unless design tests below have previously been made on insulators of identical construction and ratings as those specified, in which case the Contractor may furnish certified copies of these design tests in lieu of making the tests. All tests shall be performed in accordance with ANSI C29.1.

3.3.5.1 Design

The design tests for the post type insulators shall have been made in accordance with the requirements of ANSI C29.9.

3.3.5.2 Production

Post type insulators shall be given routine tests as specified in ANSI C29.9. Quality Conformance Tests described in ANSI C29.9 will be required for insulators furnished under the contract, unless waived in writing.

3.4 INSTALLATION

3.4.1 General

Installation shall be carried out by skilled mechanics following procedures specified by the switch manufacturer. Disconnect controls shall be wired by the contractor to existing devices in the powerhouse control room. Interrupting initiating circuits shall be wired to the points currently initiating high speed ground switches. Circuits from the new CCVT's shall be wired to terminal blocks in the powerhouse control room. The contractor shall provide RGS conduit from the CCVT structures to the line switch structure and route new circuits down existing potential transformer conduits into control room.

3.4.2 Line Connections

Make up connections between similar metals using joint compound specified in PART 2. Dissimilar metals requires a transition plate, also specified in PART 2.

3.4.3 Additional Auxiliary Switches

The number of control conductors shall be increased as required to terminate the spare auxiliary switch contacts from each switch operator at the appropriate Relay or Instrument Board.

3.5 ADJUSTING

Switch adjustment shall be carried out under the supervision of the switch manufacturers' technical representative.

3.6 ELECTRICAL TESTS

Inspect and test low voltage conductors per NETE-ATS paragraph 7.3.2. Lift terminals prior to conducting applied potential test.

3.7 FUNCTIONAL TESTS

After installation is complete, the operating mechanisms of the switches shall be tested for both manual and automatic opening and closing. The ground switch automatic trip will normally be initiated by a signal from either the transformer lockout relay, or transformer ground relay. Testing of the ground switch automatic trip, and subsequent automatic switch operation, shall be performed by actual operation of the transformer lockout relay.
